FIP I/O / MODBUS GATEWAY

Application Note for Communication between Premium CPU & XPS-MC Safety Controllers

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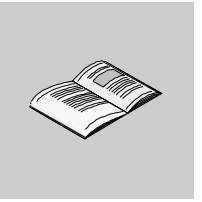

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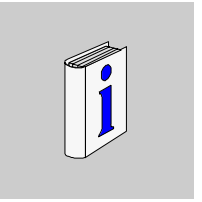

At a Glance

Document Scope

This documentation briefly describes the setup for communication between a FIP I/O Master and an XPS-MC Modbus slave. For further information about the gateway refer to the "LUFP1 Telemecanique Gateway FIP I/O / Modbus RTU User's manual"

Validity Note

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Related Documents

Title of Documentation	Reference Number
LUFP1 Telemecanique Gateway FIP I/O / Modbus RTU User's manual	LUFP1_EN.pdf (www.hms.se/abc_lufp.shtml.)

User Comments

We welcome your comments about this document. You can reach us by e-mail at techpub@schneider-electric.com

Introduction to the LUFP1 Gateway

1

Introduction to the LUFP1 Gateway

Overview

The LUFP1 gateway allows a master located on a FIP I/O network to communicate with slaves on a Modbus RTU network. This is a generic protocol converter operating in a way which is transparent to the user.
This gateway allows the user to interface many products marketed by Schneider Electric with a FIP I/O network. These include TeSys U motor starters, Altivar driver and the XPS-MC Safety Controllers.
This document concerns the communication between a Premium CPU and an XPS-MC Safety Controller. The present documentation only briefly describes the setup for communication between a FIP I/O Master and an XPS-MC Modbus slave. For further information about the gateway refer to the "LUFP1 Telemecanique Gateway FIP I/O / Modbus RTU User's manual".

Terminology

The term "RTU", refers to the Modbus RTU communication protocol and can be omitted. As a result, the term "Modbus" will refer to the Modbus RTU communication protocol.
As is still the case with all communication systems, the terms "input" and "output" are somewhat ambiguous. To avoid any confusion, we use a single convention throughout this document. So the notions of "input" and "output" are always as seen from the PLC, or the FIP I/O master.
Hence, an "output" is a command signal sent to a Modbus slave, whereas an "input" is a monitoring signal generated the same Modbus slave.
Because we are only concerned with the XPS-MC signals in this document, we have only "inputs" from the Modbus slave.

Hardware Configuration Examples

2

Introduction

Overview

This chapter contains the hardware configuration examples.

What's in this Chapter?

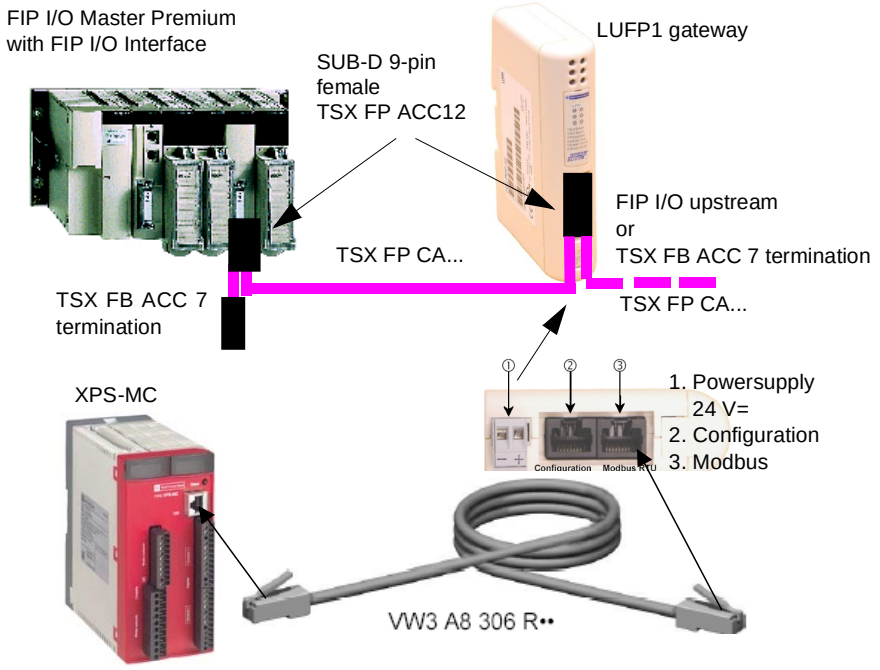
This chapter contains the following topics:

Topic	Page
Example With a Single XPS-MC Safety Controller	10
Example With Multiple XPS-MC Safety Controllers or Other Modbus Slaves	13

Example With a Single XPS-MC Safety Controller

Example

The diagram below shows the connections between a FIP I/O master (for example, Premium TSX P57 454M with the FIP I/O Interface) and a Modbus slave (XPS-MC) via the LUFP1 gateway.
Example Premium FIP I/O Master and one XPS-MC Safety Controller:



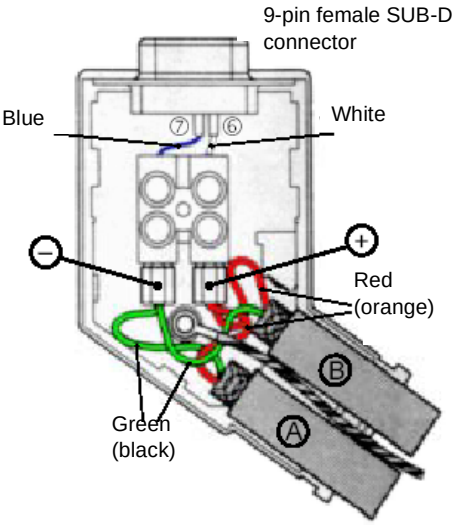
Parts used

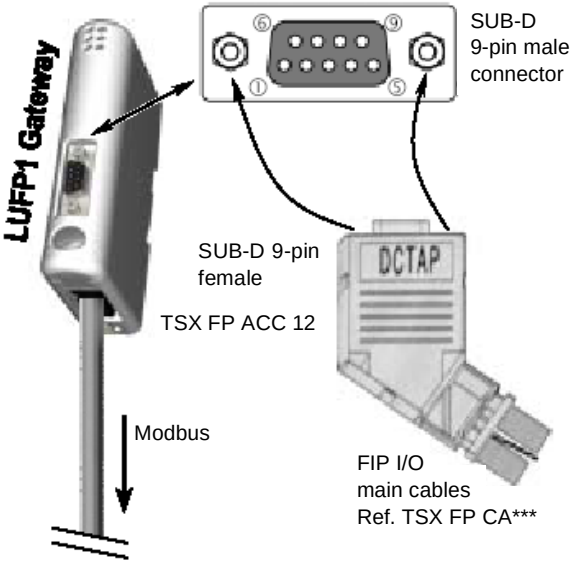
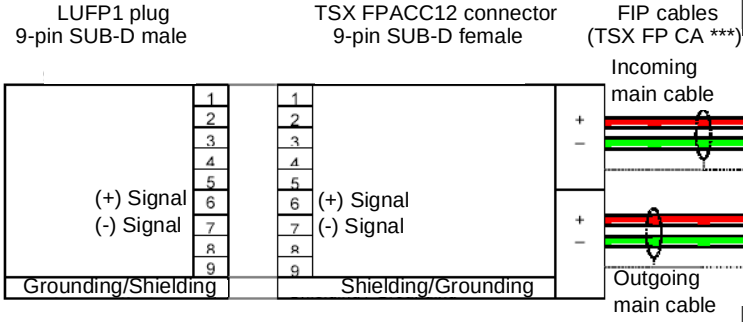
The connection between Premium and gateway requires the following parts:

- Premium CPU TSX P57454M
- LUFP1 gateway
- XPS-MC
- FIP I/O Cable: TSX FP CA...
- TSX FP ACC 7 line terminations (two in one kit)
- 2 TSX FP ACC 12 Connectors
- Modbus cable VW3 A8 306 R**

Connecting the LUFP1 Gateway to the FIP I/O Network

Steps to be followed for connecting the LUFP1 gateway to the FIP I/O network:

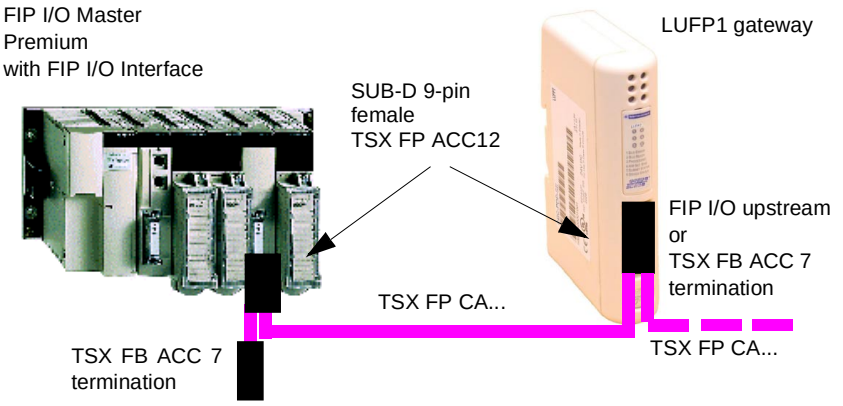
Step	Action
1	Replace one of the two cables by one of the two line terminations supplied in the TSX FP ACC 7 kit (two 150 ohm resistor) at the end of the line. The following illustration shows the wiring of the TSX FP ACC 12 connector when connecting to the main cable (two sections of TSX FP CA... cable). **TSX FP ACC 12 Connector** 

Step	Action
2	Connect the SUB-D 9-pin female plug on the FIP I/O connector to the FIP I/O plug on the LUFP1 gateway.  Pin Outs:  **Note:** If the two main cables are replaced by a TSX FP CC... tap-off cable, the **red** and **orange** wires correspond to the **(+)** signal, while the **green** and **black** wires correspondent to the **(-)** signal.

Example With Multiple XPS-MC Safety Controllers or Other Modbus Slaves

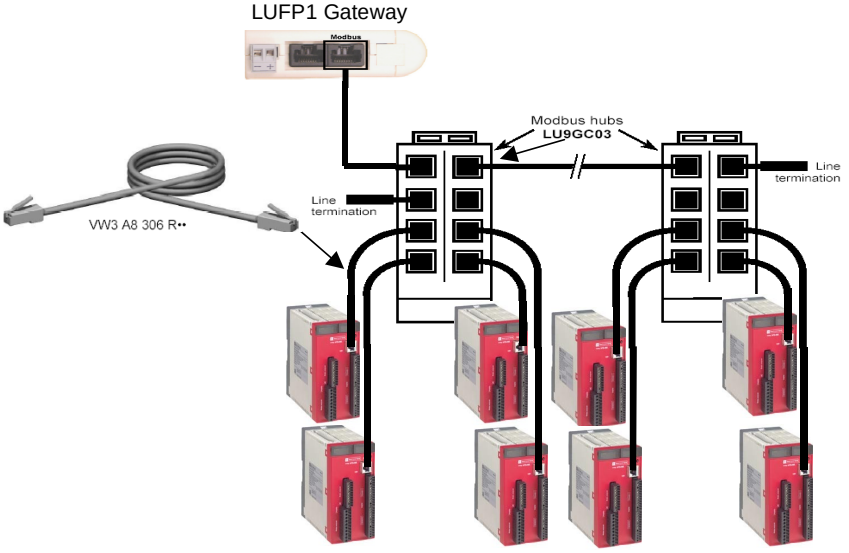
General

The connection between the Premium and the gateway will always be the same, as shown here.
Premium with LUFP1



Using Modbus Hub LU9GC03

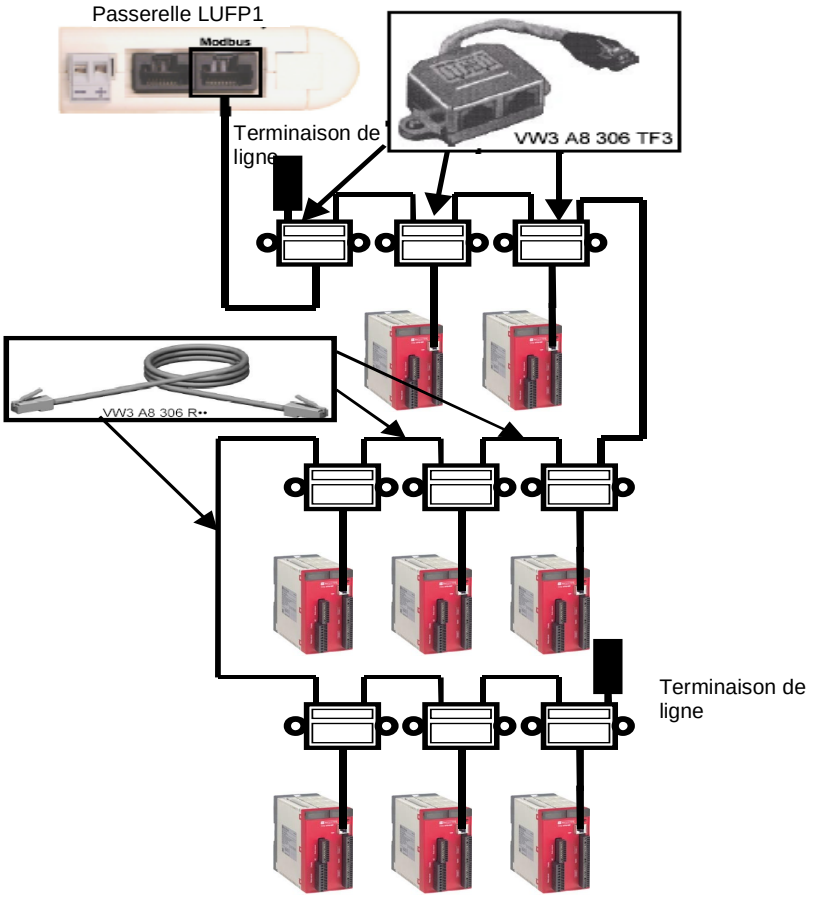
Modbus Hub LU9GC03



Maximum of 8 XPS-MC Modbus slaves

Using Bus topology with VW3 A8 306 TF3 drop boxes

VW3 A8 306 TF3 drop boxes



Line terminator

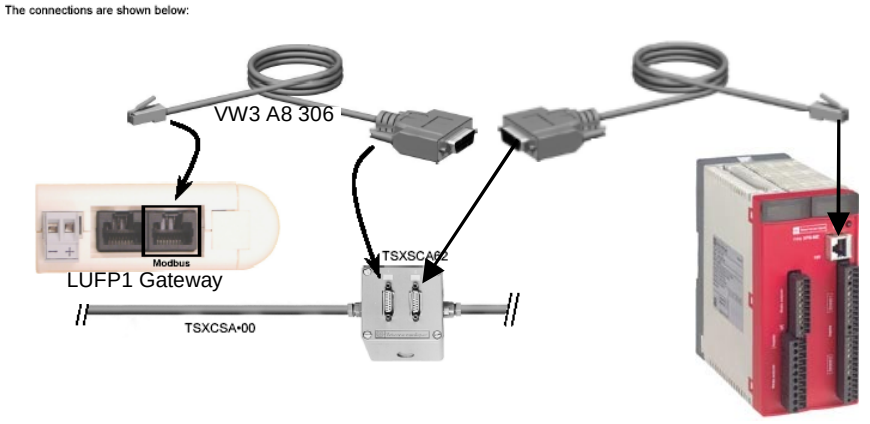
For the previous networks shown, the following line terminator is always needed for terminating the line: VW3 A8 306 RC

— VW3 A8 306 RC line termination —

Using Bus topology with tap boxes

This topology is similar to the previous one, except that it uses TSXSCA62 subscriber connectors and/or TSXCA50 subscriber connectors. We recommend using a VW3 A8 306 connection cable and the TSXCSA•00 Modbus cables. Connect the RJ45 connector on the VW3 A8 306 cable to the Modbus connector on the LUFP1 gateway.

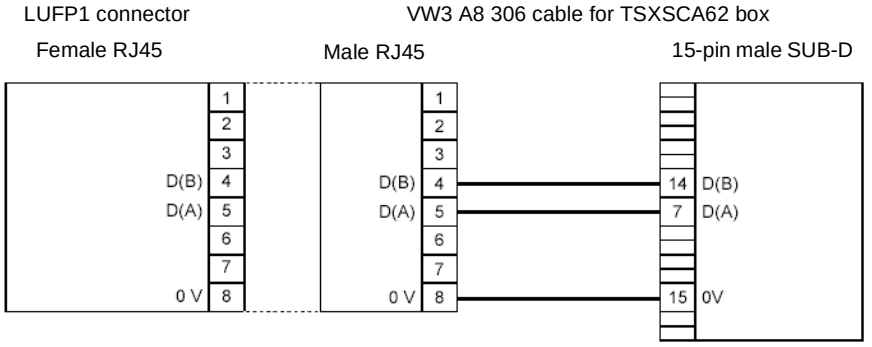
TSXSCA62 / TSXCA50 tap boxes



- TSXSCA62 box:
  This passive box has a printed circuit fitted with screw terminals and allows the connection of two subscribers to the bus two female 15 point SUB-D connectors. It includes the line termination when the connector is located at the end. It is fitted with two screw terminals for the connection of two double twisted pair Modbus cables.
- TSXSCA50 box:
  This passive box allows a Modbus unit to be connected to a screw terminal. It includes the line termination when the connector is located at the end. It is fitted with two screw terminals for the connection of two double twisted pair Modbus cables.

Pin-Outs

The pin-out for the VW3 A8 306 cable is shown below. It is the only Modbus cable that does not exclusively use RJ45 connections.
Pin-Outs



Wiring recommendations

General wiring recommendations for the Modbus network:

- Use a shielded cable with 2 pairs of twisted conductors.
- Connect the reference potentials to one another.
- The maximum length of line is 1000 meters.
- The maximum length of drop line / tap-off is 20 meters.
- Do not connect more than 9 stations to a bus (8 slaves and one LUFP1 gateway).
- Keep the bus away from power cables (at least 30 cm).
- If crossings are necessary make then at right angles.
- Connect the cable shielding to the earth on each unit.
- Adapt the line at both ends using a line terminator.

Software Configuration Examples

3

Introduction

Overview

This chapter contains the software configuration examples.

What's in this Chapter?

This chapter contains the following sections:

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3.2	LUFP1 Gateway with the ABC LUFP Configuration Tool	21
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3.4	Steps to Check When Not Running	45

3.1 Introduction of the Software Configuration Example

Example With Premium PLC and an XPS-MC Safety Controller

Introduction

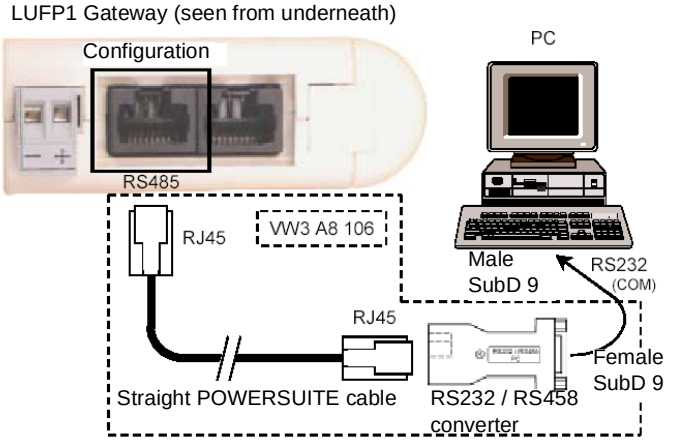
The example shows a configuration with following devices (see also *Example With a Single XPS-MC Safety Controller, p. 10*), the values shown in the pictures are the defaults with which the example was running. These values should not be changed unless neccessary.

Hardware devices:
- Premium PLC TSX P57 454M as FIP I/O MASTER
- Power supply for PREMIUM TSX PSY 2600 (230 VAC input, 24 VDC output can be taken to supply the XPS-MC and the gateway)
- LUFP1 as gateway for FIP I/O SLAVE / MODBUS MASTER
- XPS-MC as MODBUS SLAVE
- FIP I/O from Premium CPU to gateway:
  - cable: TSX FP CA...
  - TSX FP ACC 7 line terminations (two in one kit)
  - 2 TSX FP ACC 12 Connectors
- Modbus for XPS-MC to gateway:
  - VW3 A8 306 R** cable

Software devices:
- ABC LUFP configuration tool (See *LUFP1 Gateway with the ABC LUFP Configuration Tool, p. 21*)
  Note: It is recommended, that the Schneider Electric ABC tool is installed. You can download the actual one on www.hms.se/abc_lufp.shtml.
  Important: Before you install this ABC tool, you have to uninstall all other ABC tools.
- Unity Pro XL application software (See *Configure Unity Pro (FIP I/O Master), p. 41*)
- XPSMCWIN configuration tool for the XPS-MC Safety Controllers

Cables to program or configure the different modules:
- TSXPCX 1031 cable (switch in the second position: TER direct) for program the Premium CPU
- TSXPCX 1031 cable (switch in the third position: other direct) and adapter XPSMCCPC for to configure the XPS-MC
- VW3 A8 106 cable and RS232 / RS 485 converter for to configure the LUFP1

Cables to program or configure the different modules:



Note: In the following sections, it is assumed that the hardware is connected and power is on.

3.2 LUFP1 Gateway with the ABC LUFP Configuration Tool

Introduction

Overview

This section describes the steps required for the ABC LUFP configuration tool.

What's in this Section?

This section contains the following topics:

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Overview over the Data in the ABC Tool	33
Status of the gateway LEDs	35
Overview over the Information Available From the XPS-MC Safety Controller	38

LUFP1 Gateway With the ABC LUFP Configuration Tool

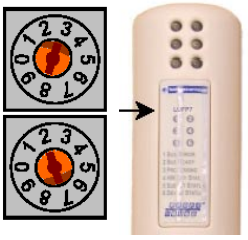
Introduction

With this tool, the gateway between the FIP I/O and the Modbus networks is configured. In this example, the FIP I/O Master is a Schneider Premium PLC and the Modbus Slave an XPS-MC Safety Controller. The following steps detail the configuration process:

Step	Action
1	Connect the hardware (See *Connect the hardware, p. 22*)
2	Install the necessary software (See *Install the necessary software, p. 22*)
3	Define the networks (See *Define the Networks, p. 23*)
4	Add commands (See *Add Commands, p. 27*)
5	Save and download to the gateway (See *Save and Download to the Gateway, p. 32*)

Connect the hardware

Steps to be followed for connecting the hardware:

Step	Action
1	Adjust the hardware address of the gateway, e.g. 73. Address = 73 Units Tens 
2	Supply 230VAC to the Premium and 24VDC to the gateway and the XPS-MC. **Note:** It may be necessary to reset the power supply when a new configuration is downloaded or the hardware address is changed.
3	Connect the FIP I/O field bus cable from gateway to Premium CPU.
4	Connect the Modbus cable from the gateway to the XPS-MC.

Install the necessary software

The installation of the following software packages is required:

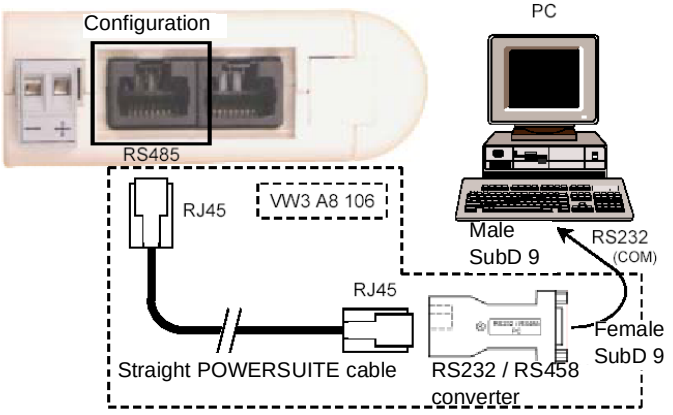
- Configuration tool ABC-LUFP Config Tool (see also *Example With Premium PLC and an XPS-MC Safety Controller, p. 19*)
- Unity Pro software
- XPS-MC configuration software

Define the Networks

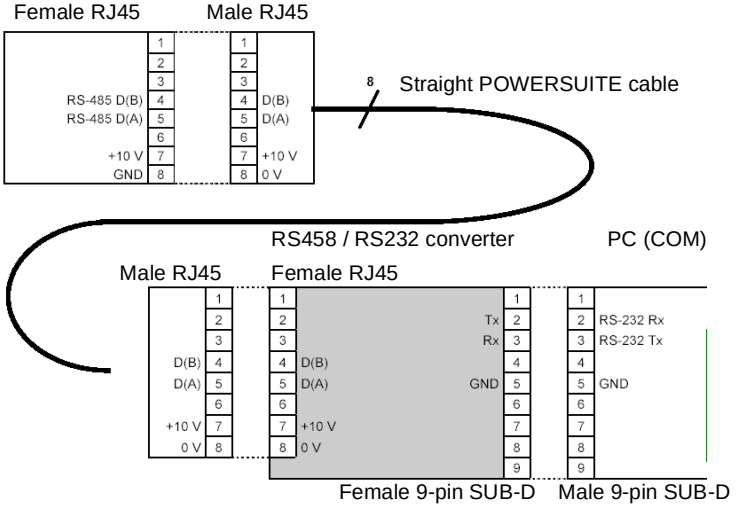
Steps to be followed for defining the networks:

Step	Action
1	Connect a PC using the PC cable and start the configuration program ABCConfigurator.

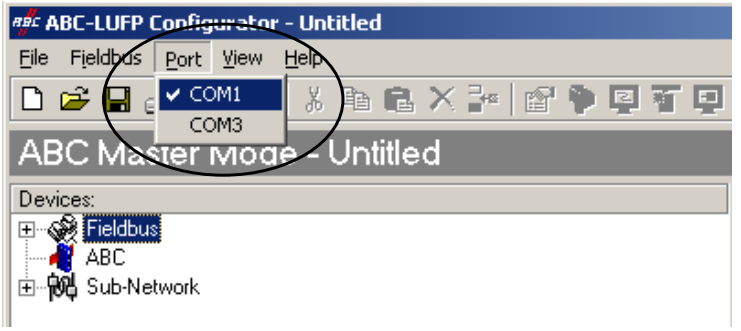
LUFP1 Gateway (seen from underneath)

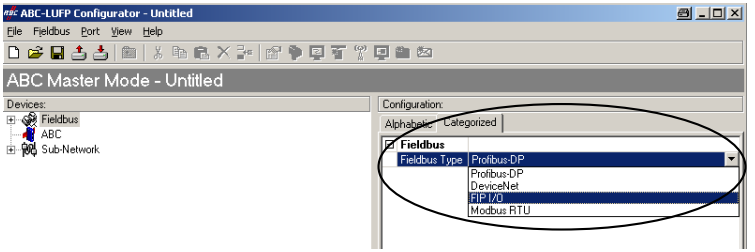
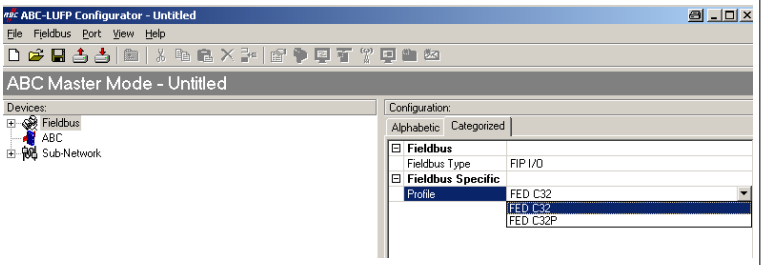
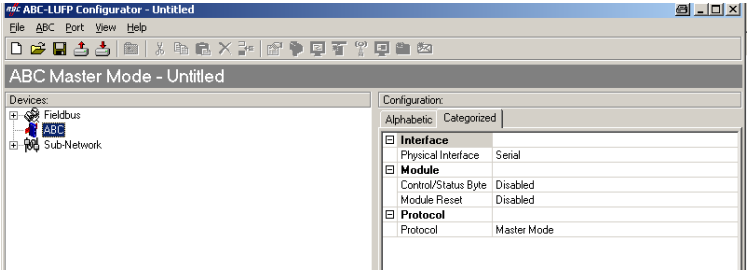


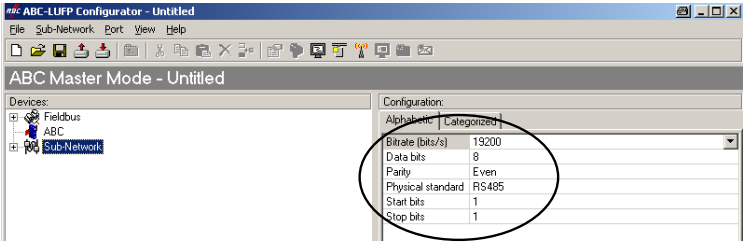
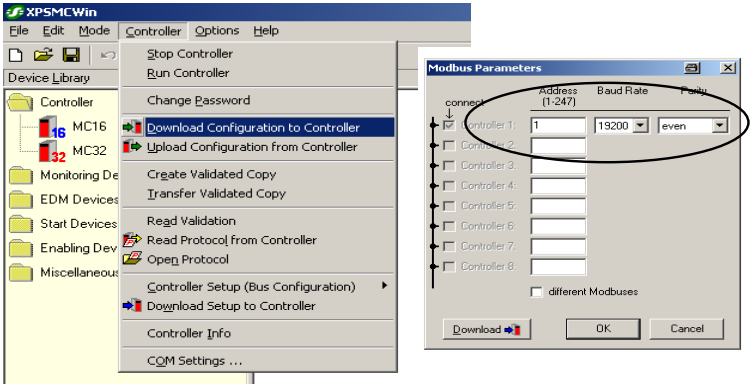
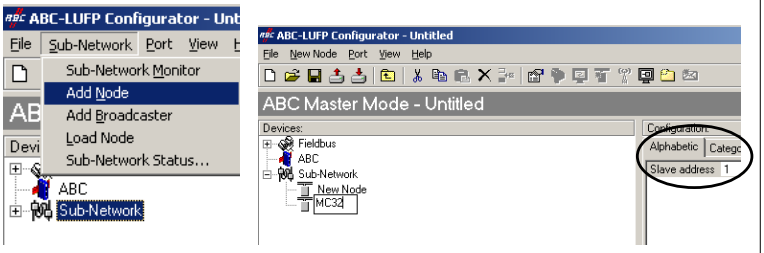
LUFP1 (Configuration)



Note: The inversion of the Rx and Tx signals between the gateway and the PC is shown on the 9-pin SUB-D connectors. Beyond this junction, the RS232 signals are replaced by the D(A) and D(B) polarisation of the RS458 signals.

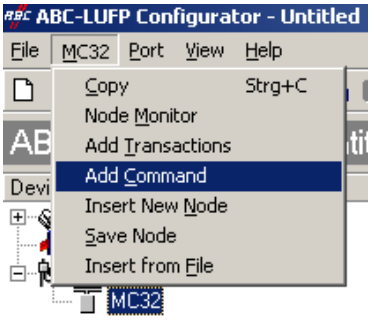
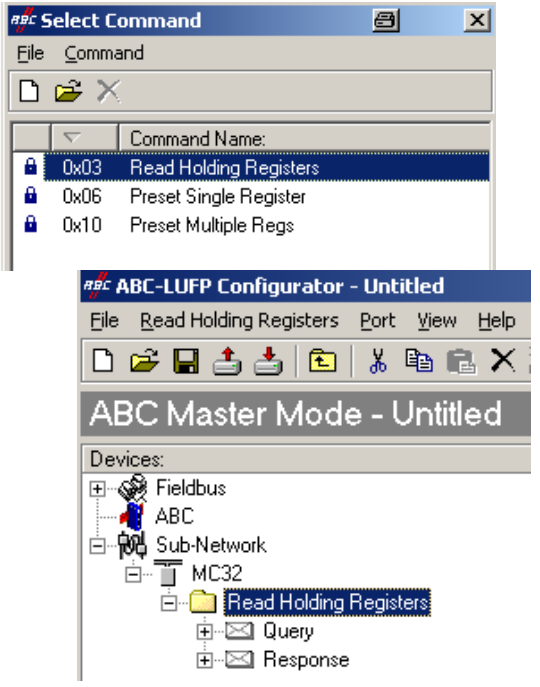
Step	Action
2	Start the ABC-LUFP-Configurator. **Result:** The following message is displayed. Click **Yes** to connect to the LUFP1 automatically, otherwise click **No**.
3	Check that the correct COM port is selected. **Note:** Sometimes the ABC tool connects to a COM, where the Modem is connected! ABC-LUFP Configurator 

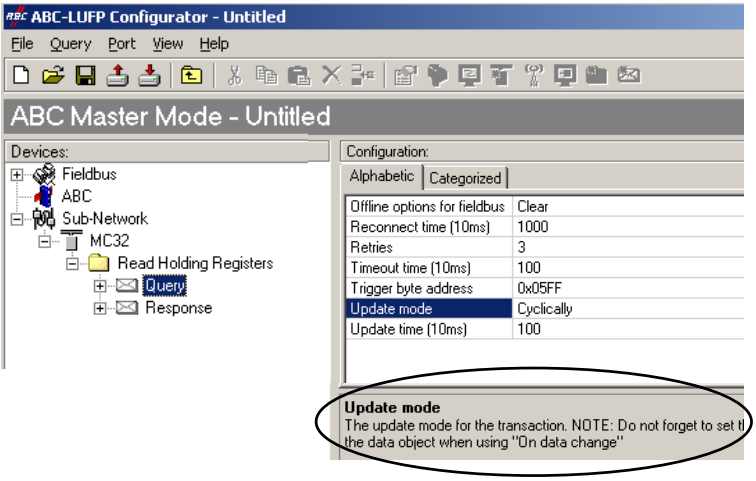
Step	Action
4	Select the FIP I/O bus. 
5	Select the fieldbus specific **FED C32**.  **Note:** Because the LUFP1 is configured using the ABC tool, the **FED C32** must be selected. If the **FED C32P** is selected, the LUFP1 can be configured using Unity Pro. **Result:** The fieldbus is configured in the gateway.
6	Check the values for part ABC. Default values for ABC 

Step	Action
7	Check the Modbus values of the sub-network.  **Note:** These must be the same values as in the XPS-MC Safety controller. See XPSMCWIN software 
8	Add new node by clicking on **Add Node**, and give the new node a name, e.g. MC32. The slave address is 1. ABC-LUFP configurator 
9	Delete the node **New Node** by selecting it and then clicking the right mouse button. **Result:** A window appears with the message: "Delete".

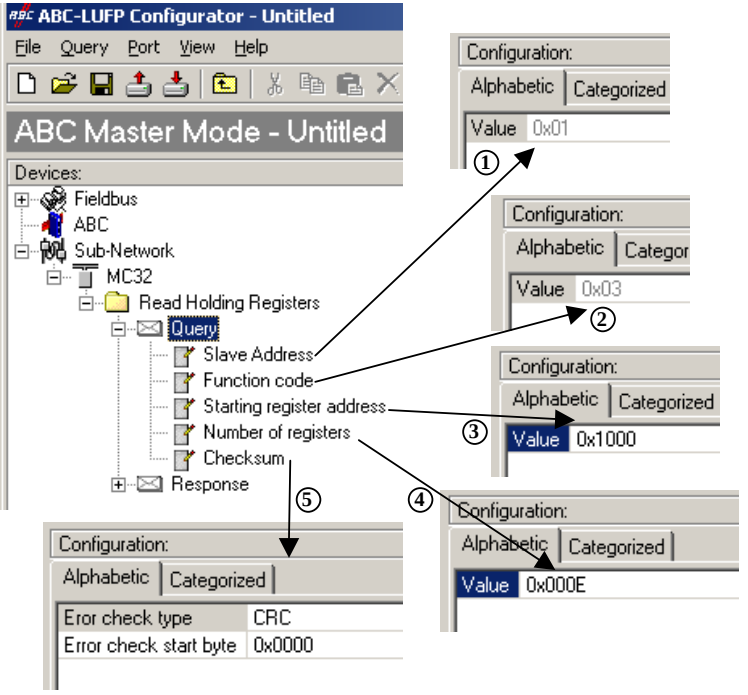
Add Commands

This example shows how to add all available commands.

Step	Action
1	Click in the left window on **MC32**. Open **MC32** in the menu bar and select **Add Command**. Add command: 
2	Double click on the command **0x03 Read Holding Registers**. 

Step	Action
3	Click on **Query** for the configuration of the query. These are the default values, do not alter.  **Note:** When you select an item in the right part of the screen, a summary about the selected item is shown in the lower part of the screen.

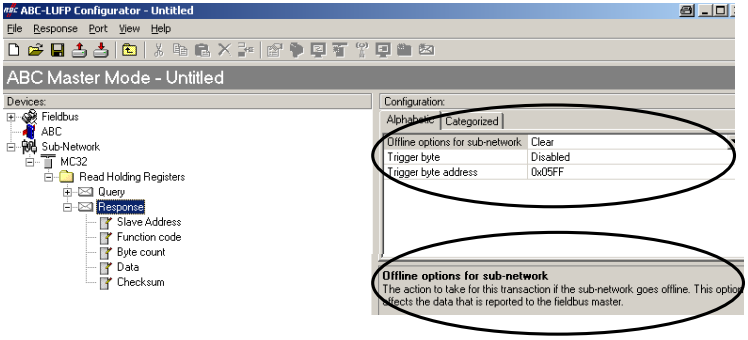
Step	Action
4	Click on the plus (**+**) to open the query.

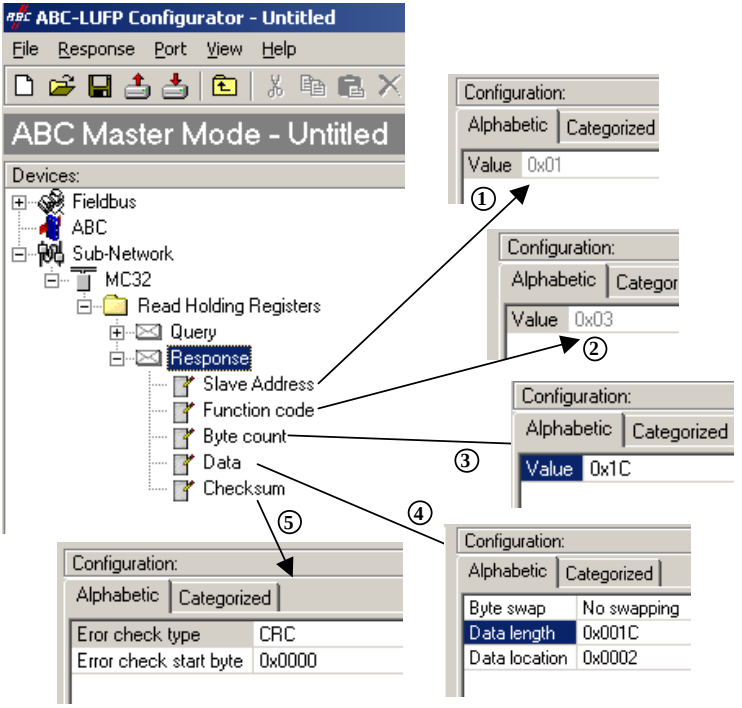


Result: There are 5 sub menus of the query:

1. Slave Address
2. Function code
3. Starting register address
   Alter value to 1000, refer to table *Addresses and Commands, p. 38* column 1
4. Number of registers
   New value is 14 (0E hex), refer to table *Addresses and Commands, p. 38* column 3
5. Checksum
   Do not alter

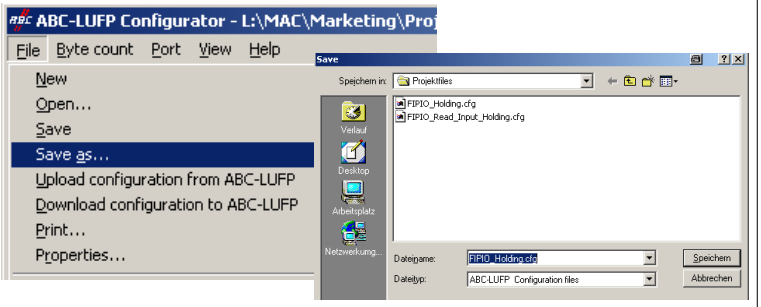
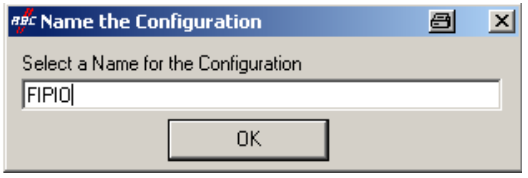
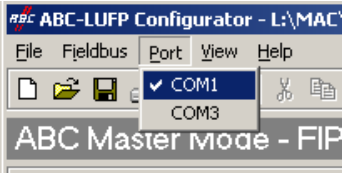
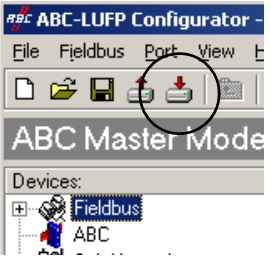
Note: In the five sub menus we have to define only the **Starting register address** and the **Number of registers** The others are fixed or the default values and are sufficient.

Step	Action
5	Configure the response by clicking on **Response**. These are the default values, do not alter.  **Note:** When you select an item in the right part of the screen, a summary about the selected item is shown in the lower part of the screen. **Result:** There are 5 sub menus of the response: • Slave Address • Function code • Byte count Change into 28 (1C hex), 14 registers each with one word or two bytes. Refer to table *Addresses and Commands, p. 38*. • Data The length is 28 bytes, data location is 2, because the first 2 bytes are used by the status of the gateway. Refer to table *Addresses and Commands, p. 38*. • Checksum Do not alter.

Step	Action
6	In the five sub menus, only the **Byte count** and the **Data** must be defined. The others are fixed or the default values are sufficient. 

Save and Download to the Gateway

Steps to be followed for saving and downloading to the gateway:

Step	Action
1	Save the configuration on the harddisk. 
2	Give a name for the configuration. 
3	Check the correct COM port before downloading. 
4	Download to the gateway. 

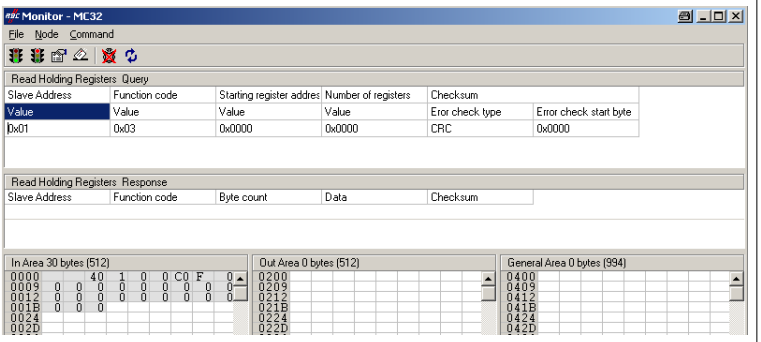
Result

The gateway is now configured.

Overview over the Data in the ABC Tool

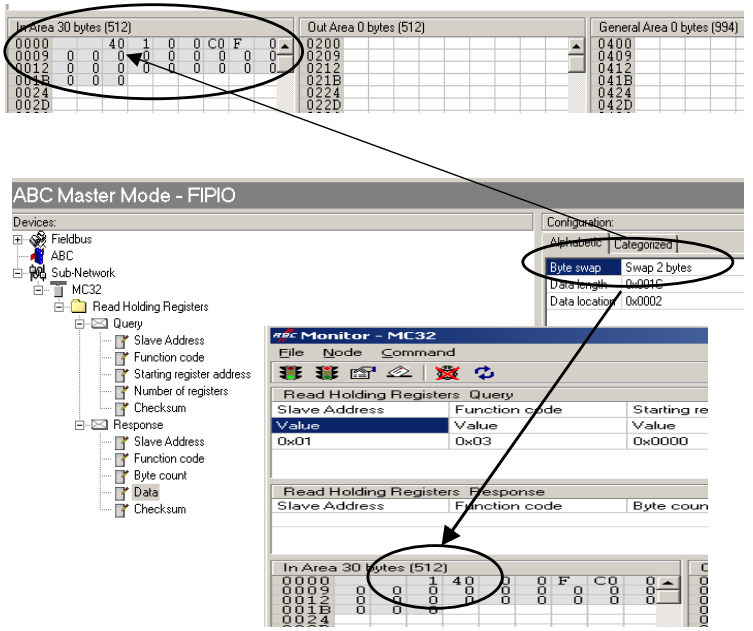
Show the node monitor

Steps to be followed for displaying the data:

Step	Action
1	Click on the node **MC32**.
2	Click on the icon **Node monitor** . **Result:** The following window appears with the data from the Secuflex XPS-MC.  **Result:** The first two bytes are used by the gateway. The next two bytes are the data of the address 1000 (Hardware and configuration).

Correct swapped bytes

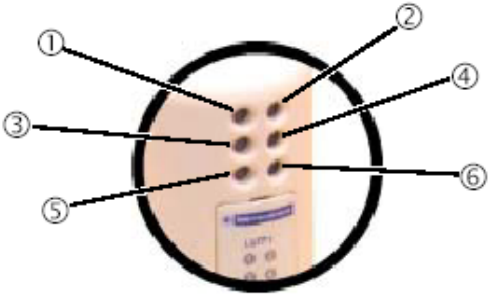
Steps to be followed in the ABC tool if the two bytes are swapped:

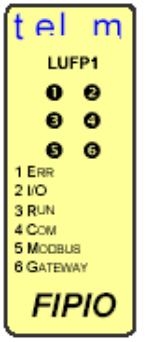
Step	Action
1	Click on the **Response** menu.
2	Click on **Data** and open the pull down menu in the right side window. 

Status of the gateway LEDs

LED description

Overview of the gateway LEDs





Description of the LED status:

LED	Status	Meaning
1 = ERR	Off	Gateway online (exchanges possible)
	Flashing (red)	Gateway offline (exchanges impossible) Proceed as follows: ● Check in PL7 Pro, that a FIP I/O station has been declared for the gateway address. ● Check that the gateway is correctly connected to the FIP I/O network.
2 = I/O	Off	No fault
	Red	Internal fault Proceed as follows: ● Replace the gateway
	Flashing (red)	Timing failure **Note:** Fault mainly due to FIP I/O network and/or FIP I/O master.
3 = RUN	Off	No power, or critical fault.
	Green	Gateway operational
	Flashing (green)	Duplicate address
4 = COM	Off	Total absence of communication with bus arbitrator.
	Flashing, 5Hz (yellow)	Exchanges in progress with bus arbitrator.

LED	Status	Meaning
5 = MODBUS	Off	No power
	Green	Modbus communications OK with all Modbus slaves.
	Red	Loss of communication with one or more Modbus slaves.
	Flashing (green)	No Modbus communications.
6 = GATEWAY	Off	No power
	Green	Initialisation and configuration of the gateway.
	Flashing (green)	Gateway in operation.
	Flashing (red/ green)	Configuration absent / invalid. Proceed as follows: ● Use ABC-Conf to load a valid configuration.

LED displays

There are three possibilities when the gateway is configured correctly.
Modbus and FIP I/O are not connected to the gateway:

LED display	LED	Status	LED	Status
	1	Flashing (red)	2	out
	3	Green	4	out
	5	Red	6	Flashing (green)

Modbus is not connected but FIP I/O is connected to the gateway, and FIP I/O is running:

LED display	LED	Status	LED	Status
	1	out	2	out
	3	Green	4	Flashing (orange)
	5	Red	6	Flashing (green)

Modbus and FIP I/O are connected to the gateway, and both are running:

LED display	LED	Status	LED	Status
	1	out	2	out
	3	Green	4	Flashing (orange)
	5	Green	6	Flashing (green)

Overview over the Information Available From the XPS-MC Safety Controller

Overview

The following describes the information transmitted by the XPS-MC over Modbus. In the HOLDING Register (command 03) you can see in addition to the diagnostics, also the information for the INPUTS (command 01) and the OUTPUTS (command 02). The last line is the holding register (Address 1000 - 100D). Only this line is of interest.

Addresses and Commands

Addresses and commands:

Addresses (hexadecimal)	Addresses (decimal)	Size of Data	Supported Modbus Function	Results for Usage
0100-0127	256-295	40 bits	01 (0x01)	8 bit output data /32 bit input data (0 = OFF, 1 = ON)
0200-0227	512-551	40 bits	02 (0x02)	32 bit input data /32 bit output data (0 = OFF, 1 = ON)
1000-100D	4096-4109	14 words	03 (0x03)	Information and errors for details refer to next table

Holding Registers

Information about the 14 words of the holding registers:

Word Address (hexa-decimal)	Word Address (decimal)	High Byte	Low Byte	Details
Hardware and Configuation				
1000	4096	Mode	Status	Mode bit4: 0 = XPSMC32 bit4: 1= XPSMC16 bit6: 1 = config OK Status bit0: 1 = RUN bit1: 1 = CONF bit3: 1 = INT Error bit4: 1 = EXT Error bit5: 1 = STOP
1001	4097			reserved

Word Address (hexa-decimal)	Word Address (decimal)	High Byte	Low Byte	Details
I/O-Data				
1002	4098	Input data (Input 1-8)	Input data (Input 9-16)	Bit 1 = corresponding in/output on
1003	4099	Input data (Input 17-24)	Input data (Input 25-32)	
1004	4100	not used (always 0)	Output data (Output 1-8)	
I/O-Errors				
1005	4101	Input error (Input 1-8)	Input error (Input 9-16)	Bit 1 = corresponding in/output error
1006	4102	Input error (Input 17-24)	Input error (Input 25-32)	
1007	4103	not used (always 0)	Output error (Output 1-8)	
Diagnostic Hints (DH)				
1008	4104	(DH 1) Index High	(DH 1) Index Low	Index * number of devices Message Diagnostic Hint Significtaion: see next table * The index gives the order of the devices in the configuration. The indexes for all devices can be found in the protocol of the configuration.
1009	4105	not used (always 0)	(DH 1) Message	
100A	4106	(DH 2) Index High	(DH 2) Index Low	
100B	4107	not used (always 0)	(DH 2) Message	
100C	4108	(DH 3) Index High	(DH 3) Index Low	
100D	4109	not used (always 0)	(DH 3) Message	

Diagnostic in the Holding Registers

Error meassage and indication of XPS-MC:

Code No.	Meaning	Status
0	OK, no message	Operation
1	Short-circuit between inputs	Error
2	Hardware defect	
3	Muting error	
4	Override timeout	
5	Timeout error	
6	Over travel exceeded	
7	Short-circuit	
8	Muting lamp defect	
9	Cam switch mechanism defect	
10	Press safety valve defect	
11	External voltage defect	
12	Output will not switch ON	
13		
14		
15		
16	Reset button blocked	Indication
17	Timeout	
18	Incomplete opening	
19	Start interlock active	
20	Open circuit	
21	Delay time running	
22	Check locking device	
23	Check valve	
24	Unexpected muting signal	
25		
26		
27		
28		
29		
30		
31		

3.3 Configure Unity Pro (FIP I/O Master)

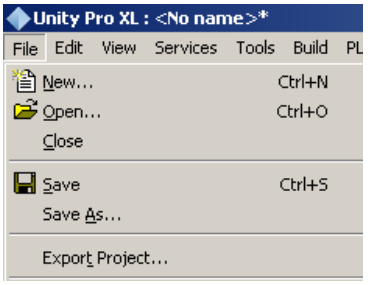
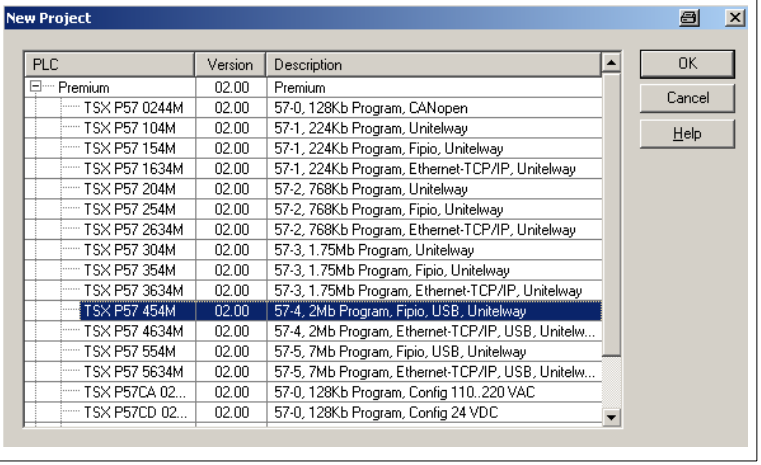
Configure Unity Pro (FIP I/O Master)

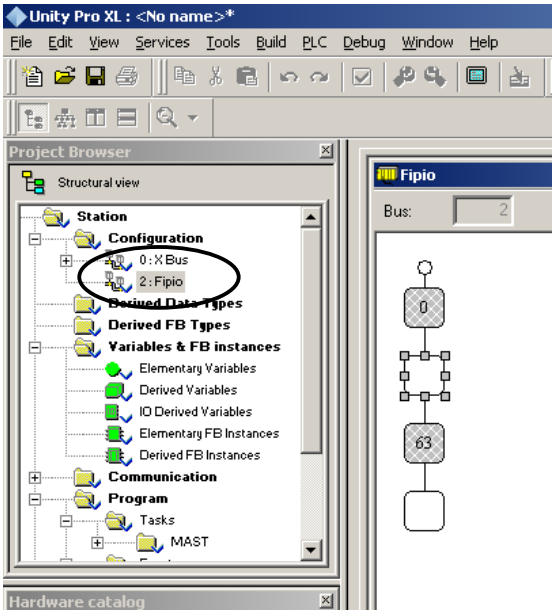
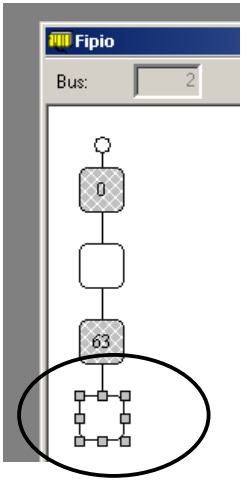
Introduction

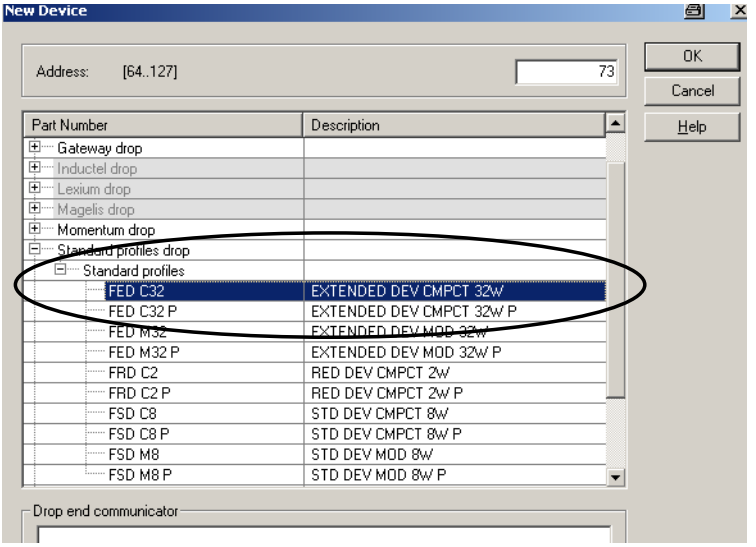
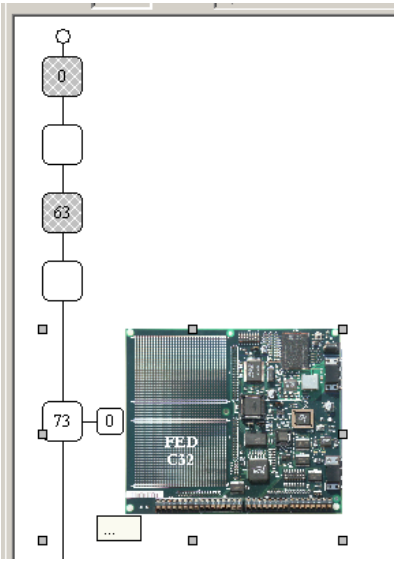
To run the FIP I/O you need a Master. In this example we take the Schneider Premium TSX P57 454M with the FIP I/O Interface included.

Configure Unity Pro

Steps to be followed for configuring Unity Pro:

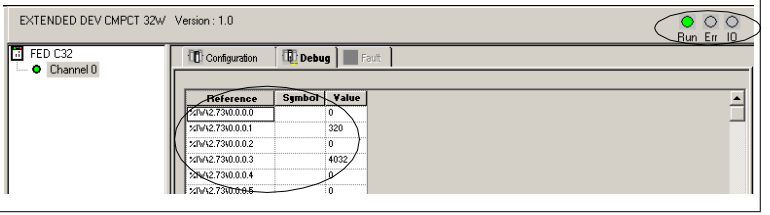
Step	Action
1	Start Unity Pro.
2	Open new project. 
3	Select the PLC with the FIP I/O interface. 

Step	Action
4	Open the FIP I/O window by double click on the **Fipio**. 
5	Double click on the rectangle. 

Step	Action
6	Select the correct device and type (**FED C32**) in the address 73.  **Result:** The following figure shows the result. 

Download the program

Steps to be followed for downloading the program to the CPU:

Step	Action
1	Generate the project.
2	Connect to the Premium.
3	Download the program.
4	Run the CPU.
5	Double click on the above board. **Result:** The following window appears, on the right side with the data from XPS-MC32: 

Result

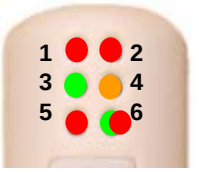
Your system is now working.
If you encounter any problems proceed with *Steps to Check When Not Running, p. 45*.

3.4 Steps to Check When Not Running

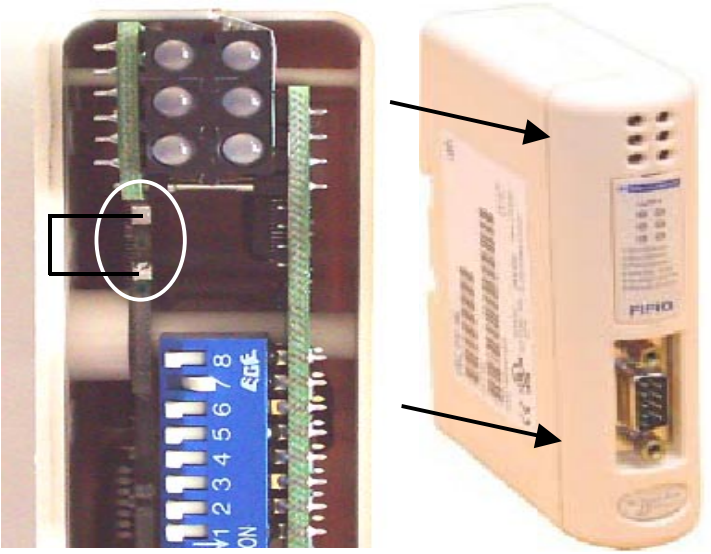
Steps to Check When Not Running

Gateway hardware reset

If the gateway has been configured incorrectly, communication may not be possible. The LED will flash red / green:

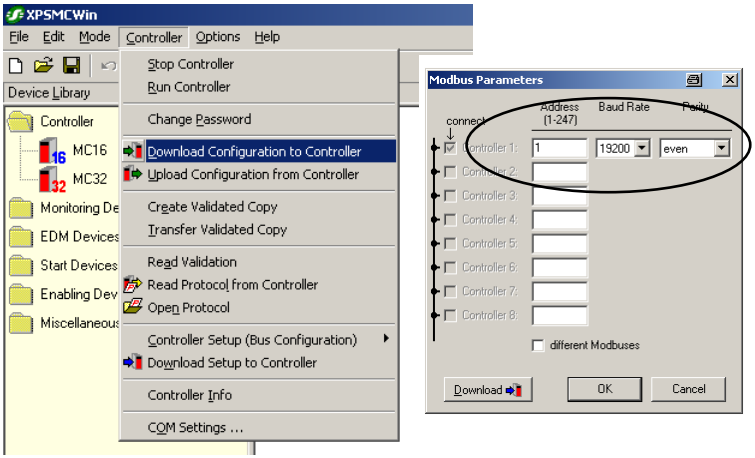
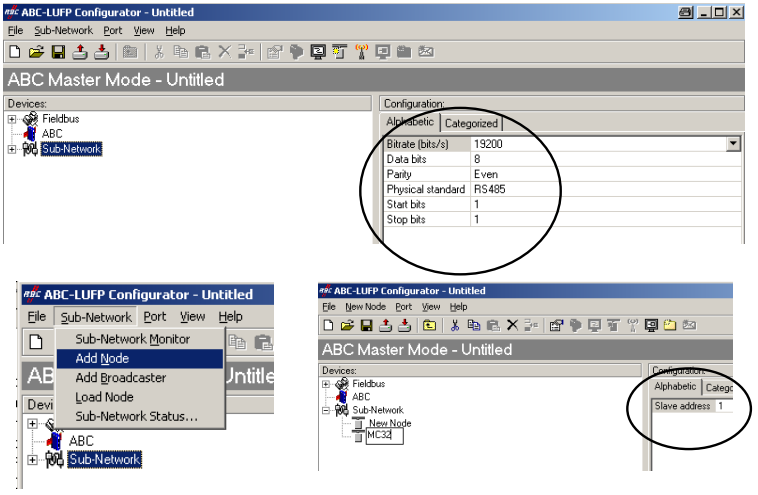
LED display	LED	Status	LED	Status
	1	Flashing (red)	2	Flashing (red)
	3	Flashing (green	4	Flashing (orange)
	5	Red	6	Flashing (red / green)

Steps to be followed for resetting the gateway hardware:

Step	Action
1	Unplug the gateway from the power supply.
2	Open the gateway at the front.
3	Make a connection between the two points, shown in the following figure. **Note:** While the connection is made, apply power to the module. 
4	Download a valid configuration with the **ABCConfigurator** to the gateway.

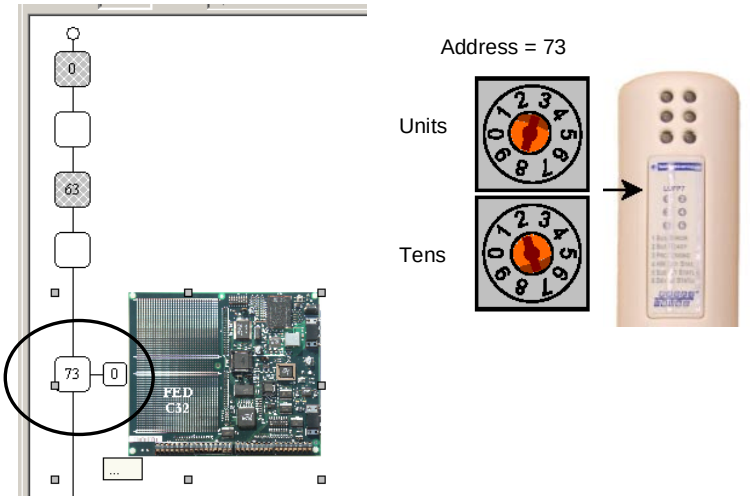
Correct Modbus configuration

Steps to be followed when the system is not running:

Step	Action
1	Check that the **XPS-MC Safety Controller** has the correct configuration, specifically the correct MODBUS address. In our example, the XPS-MC address is 1! 
2	Correct MODBUS configuration in XPS-MC Safety Controller and in the ABC LUFP: 

Correct switch position on the FIP I/O gateway

Steps to be followed when the system is not running:

Step	Action
1	Check if the hardware rotary switches on the gateway are in the correct position (in our example 73) and Unity Pro has the same address! 
2	Check if you have chosen the correct module: Standard Profile Drop, Standard profiles, FED C32.